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DEVELOPMENT OF YOUNG WESTERN WHITE PINE PLANTATIONS

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ABSTRACT

Study of two young western white pine plantations reveals their growth to be much faster than that of natural stands of comparable age. Data from a third plantation provide additional information on effects of site and density.

INTRODUCTION

Among the many advantages claimed for the establishment of stands by planting are a shorter regeneration period, better spacing, control of composition, and faster growth rates. Advantages and disadvantages vary with species, economics, and site capabilities.

What claims can be made for western white pine plantations? Measurements made on three young white pine plantations in Montana and Idaho provide some quantitative information on growth, stand structure, and effects of density and site that should be useful in planning regeneration and management.

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LOCATION AND PLOT ESTABLISHMENT

Two of the plantation areas studied had been denuded by the disastrous forest fire of 1910. One, located on the Lolo National Forest near the head of the St. Regis River in Montana, was planted in 1918 and contains a small natural component of western larch, lodgepole pine, and Engelmann spruce. Planting of the other area, near Cathedral Peak on the Coeur d'Alene National Forest in Idaho, was accomplished in 1924 following a second fire in 1919. Because of the double burn, this plantation remains virtually pure white pine.

In 1947, four 1/10-acre permanent sample plots were established in the 29-year-old St. Regis plantation and five in the 23-year-old plantation near Cathedral Peak.² Measurements taken at that time, and again in 1952 and 1957, included crown class, diameter, and total height. Site quality on both sets of plots ranged from fair to excellent.

The third plantation was established at the Deception Creek Experimental Forest in Idaho in 1936 following harvest of an old-growth white pine stand and controlled broadcast burning as a site preparation measure. Originally the planting was designed as a comparison of 4-, 6-, and 8-foot spacings, but variations in survival plus the entry of natural reproduction of white pine and associated species modified the planned spacings. Measurements of diameter, total height, and height to live crown were taken in 1958 on five temporary 1/10-acre plots to determine effects of differing densities on growth and natural pruning. Site quality as measured by 8-year height growth intercept was uniform among these plots.

RESULTS FROM ST. REGIS AND CATHEDRAL PEAK PLANTATIONS

Growth rates during the 10-year period of measurement were similar on both areas (table 1). Annual increases averaged about 200 cubic feet per acre in volume and slightly less than 0.2 inch in tree diameter. Mortality was higher in the older stand because of heavier densities, but was limited to small subordinate trees.

The effect of site differences among these plots almost entirely obscured the effect of stocking variations. Average periodic volume increment, ranging from 175 to 264 cubic feet per year, generally corresponded to the range of site classes (SI 50 to SI 70).

The freedom of young planted western white pine from intense competition contrasts with early conditions in fully stocked natural stands. The benefits of uniform stocking include less skewed diameter distribution and faster growth (fig. 1). During the 10-year measurement period, the St. Regis plantation maintained a growth margin over comparable natural stands of about 50 percent in average stem diameter, 30 percent in diameter of dominant and codominant trees, 20 percent in basal area per acre, and 35 percent in volume per acre (table 2). At the Cathedral Peak plantation, concentration of growth on fewer trees resulted in even better performance.

² Plots were established by C. A. Wellner and A. E. Helmers.

Table 1. - Stand and stocking changes in the Cathedral Peak and St. Regis plantations over a 10-year period

Plantation and stand age (years)	Trees per acre	Average diameter	Basal area per acre	Volume per acre
	<u>Number</u>	<u>Inches</u>	<u>Sq. ft.</u>	<u>Cu. ft.</u>
Cathedral Peak:				
23	900	4.2	85	1,000
28	880	5.1	125	2,020
33	860	6.0	167	3,150
Average annual change	-4	0.18	8	215
St. Regis:				
29	1,135	4.7	133	2,280
34	1,060	5.4	168	3,260
39	870	6.4	192	4,290
Average annual change	-27	0.17	6	201

Table 2. - Plantation growth expressed as percentage of values for natural stands^{1/} at equivalent ages

Plantation and stand age (years)	Trees per acre	Mean d.b.h.		Basal area per acre	Cu. vol. per acre
		All trees	D & CD ^{2/}		
----- <u>Percent</u> -----					
Cathedral Peak:					
23	21	221	181	105	131
28	25	222	144	119	155
33	30	214	131	127	164
St. Regis:					
29	48	157	131	113	136
34	53	150	135	119	136
39	51	152	130	119	134

^{1/} Haig, I. T. Second-growth yield, stand, and volume tables for the western white pine type. U.S. Dept. Agr. Tech. Bull. 323, 67 pp. 1932.

^{2/} Dominant and codominant trees only.

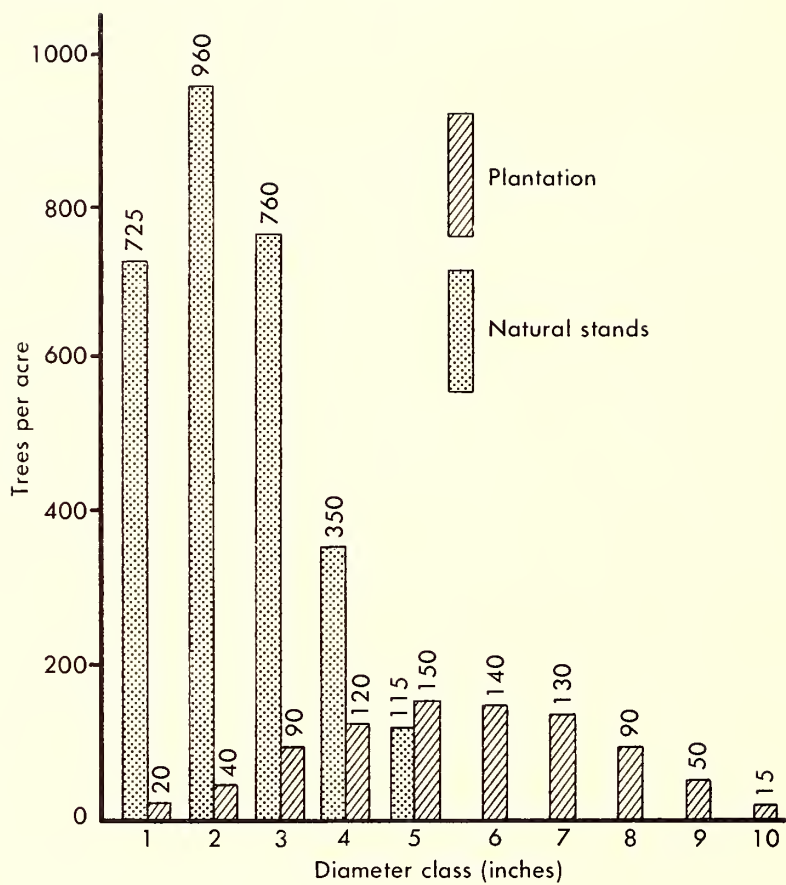


Figure 1.--Number of trees per acre by diameter class in a 33-year-old western white pine plantation (Cathedral Peak) as compared to the number in natural stands of similar age.

RESULTS FROM DECEPTION CREEK PLANTATION

Evidence of how much growth reduction can be caused by increased plantation density is provided by temporary plot data from essentially uniform sites at the Deception Creek Experimental Forest (fig. 2).

When the plantation was 23 years old, the diameter of the average white pine was 20 percent greater at a basal area stocking of 73 square feet per acre (1,370 trees) than at 113 square feet (2,500 trees) per acre. But, thus far, density of this range has not affected growth of the 200 largest white pine trees per acre. Diameters of these potential crop trees average about 5 inches on all plots; their height growth since establishment has averaged nearly 2 feet per year.

Conditions of heavier stocking have hastened the shading out of lower limbs, but not to any important degree (fig. 3). At 23 years, trees in the most densely stocked areas differed from those in the least densely stocked areas by only about 2 feet in height to live crown.

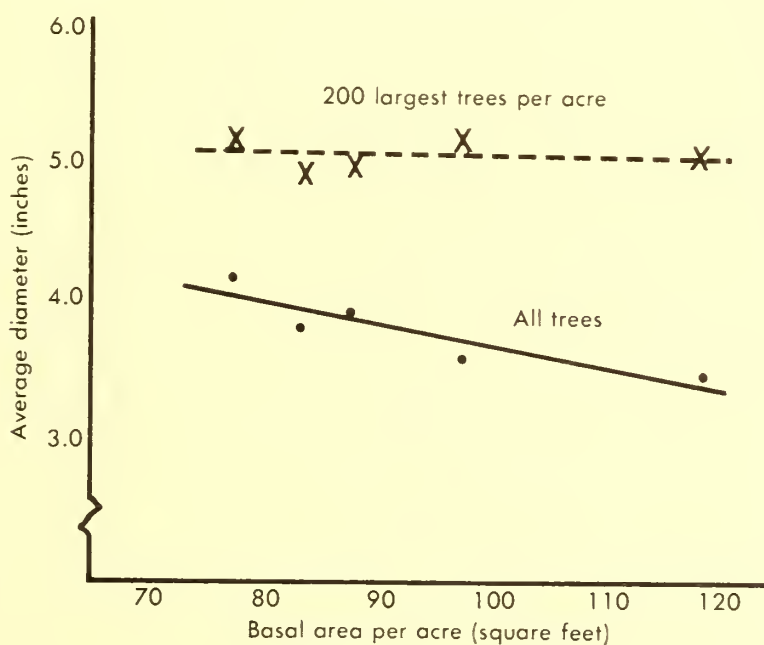


Figure 2. --Effect of stocking on average diameter of 23-year-old planted western white pine, Deception Creek Experimental Forest.

DISCUSSION

Performance of western white pine in young plantations was markedly superior to that of natural stands. One reason for this superiority is that plantations become quickly established, whereas natural regeneration of western white pine stands may take many years. Second, the growth capabilities of the site are utilized by fewer, well-distributed trees. Other obvious advantages of plantations include easier application of cultural treatments and much greater control over species composition than can be achieved in natural stands.

The last periodic annual increment measurements differed by 50 percent between fair and excellent sites. This divergence demonstrates the importance of properly evaluating site quality before assigning area priorities for planting. Close spacing and consequent early stand closure quickly retard the diameter growth of the average plantation tree. However, time for starting needed thinnings is provided by the apparent delay of adverse effects on the larger potential crop trees.

Higher stand densities resulted in slightly earlier mortality of lower crown portions. Since dead branches persist on western white pine for 50 years or more,³ early shading out of lower limbs probably would not improve wood quality significantly at harvest.

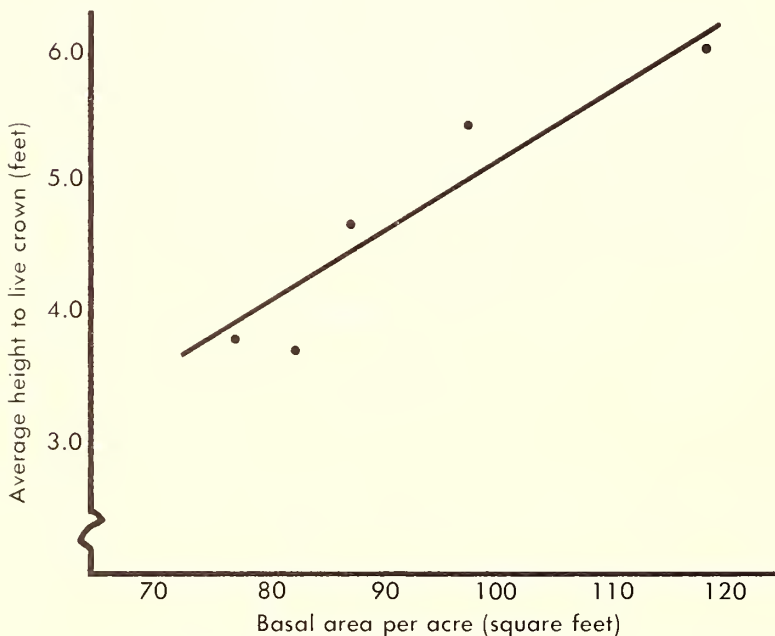


Figure 3. --Effect of stocking on height to live crown of 23-year-old planted western white pine, Deception Creek Experimental Forest.

³ Rapraeger, E. F. Development of branches and knots in western white pine. Jour. Forestry 37: 239-245. 1939.

